

Model Name: T240XW01 V1

Issue Date : 2009/12/23

(*) Preliminary Specifications

() Final Specifications

Customer Signature	Date	AUO	Date
Approved By _____		Approval By PM Director Frank Hsu _____	
Note		Reviewed By RD Director Eugene CC Chen _____	
		Reviewed By Project Leader Wenti Chang _____	
		Prepared By PM Fanglan Hsu _____	

Contents

No		
		CONTENTS
		RECORD OF REVISIONS
1		GENERAL DESCRIPTION
2		ABSOLUTE MAXIMUM RATINGS
3		ELECTRICAL SPECIFICATION
	3-1	ELECTRICAL CHARACTERISTICS
	3-2	INTERFACE CONNECTIONS
	3-3	SIGNAL TIMING SPECIFICATION
	3-4	SIGNAL TIMING WAVEFORM
	3-5	COLOR INPUT DATA REFERENCE
	3-6	POWER SEQUENCE
	3-7	BACKLIGHT SPECIFICATION
4		OPTICAL SPECIFICATION
5		MECHANICAL CHARACTERISTICS
6		RELIABILITY TEST ITEMS
7		INTERNATIONAL STANDARD
	7-1	SAFETY
	7-2	EMC
8		PACKING
	8-1	DEFINITION OF LABEL
	8-2	PACKING METHODS
	8-3	PALLET AND SHIPMENT INFORMATION
9		PRECAUTION
	9-1	MOUNTING PRECAUTIONS
	9-2	OPERATING PRECAUTIONS
	9-3	ELECTROSTATIC DISCHARGE CONTROL
	9-4	PRECAUTIONS FOR STRONG LIGHT EXPOSURE
	9-5	STORAGE
	9-6	HANDLING PRECAUTIONS FOR PROTECT FILM

Record of Revision

[illegible]

1. General Description

This specification is applied to the 24 inch Color TFT-LCD Module T240XW01. This LCD module has a TFT active matrix type liquid crystal panel with 1,366x768 pixels, and the diagonal size is 24.02 inches. This module supports 1,366x768 XGA-WIDE mode (Non-interlace).

Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in horizontal stripes. Gray scale or the brightness of the sub-pixel color is determined with an 8-bit gray scale signal for each dot.

The T240XW01 has been designed to apply to 8-bit and 1 channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

This module is not equipped with inverter board for backlight.

* General Information

Items	Specification	Unit	Note
Active Screen Size	24.02	inch	
Display Area	531.7155 (H) x 298.944 (V)	mm	
Outline Dimension	580 (H) × 347.5 (V) × 46.7 (D)	mm	Without inverter
Driver Element	a-Si TFT active matrix		
Display Colors	8 bit, 16.7M	Colors	
Number of Pixels	1,366 x 768	Pixel	
Pixel Pitch	0.38925 (H) x 0.38925 (W)	mm	
Pixel Arrangement	RGB horizontal stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-Glare, 3H		Haze=13%

2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit

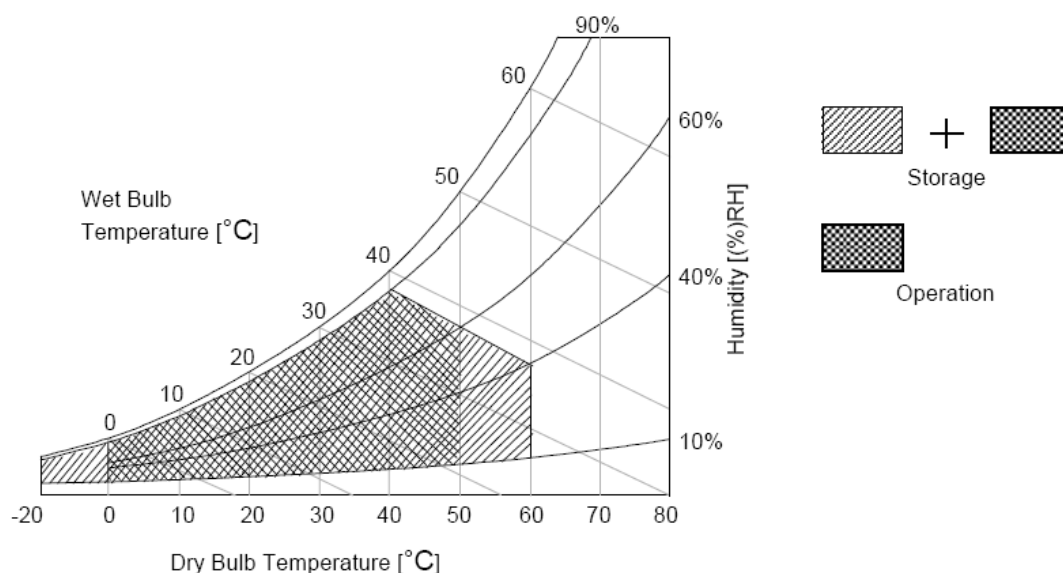
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vcc	-0.3	6	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST		65	[°C]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39°C and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 3: Surface temperature is measured at 50°C Dry condition



3. Electrical Specification

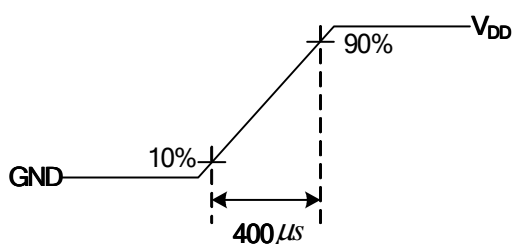
The T240XW01 V1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input for BLU is to power inverter.

3.1 Electrical Characteristics

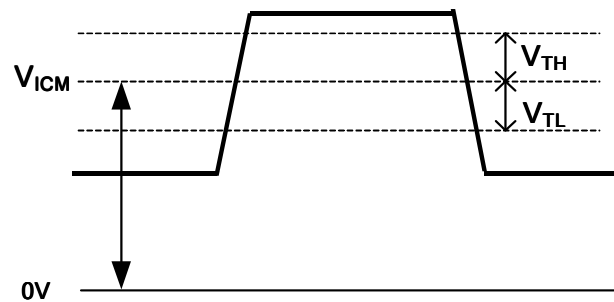
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LCD							
Power Supply Input Voltage		V_{DD}	4.5	5.0	5.5	V_{DC}	1
Power Supply Input Current		I_{DD}	-	0.8	1.0	A	2
Power Consumption		P_C	-	4.0	5.0	Watt	2
Inrush Current		I_{RUSH}	-	-	3	A	3
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}	--	--	+100	mV_{DC}	4
	Differential Input Low Threshold Voltage	V_{TL}	-100	--	--	mV_{DC}	4
	Input Common Mode Voltage	V_{ICM}	1.10	1.25	1.40	V_{DC}	4
CMOS Interface	Input High Threshold Voltage	V_{IH} (High)	2.7	--	3.3	V_{DC}	
	Input Low Threshold Voltage	V_{IL} (Low)	0	--	0.6	V_{DC}	
Backlight Power Consumption		P_{BL}	45	50	55	Watt	
Life Time			30000		--	Hours	5,6,7

Note :

- The ripple voltage should be controlled under 10% of V_{CC}
- Test Condition:
 - $V_{DD} = 5.0V$
 - $F_v = \text{Type Timing, } 60Hz$
 - $F_{CLK} = 82.0 \text{ MHz}$
 - Temperature = 25 °C
 - Test Pattern : White Pattern
- Measurement condition : Rising time = 400us



4. $V_{ICM} = 1.25V$



5. Do not attach a conducting tape to lamp connecting wire. If the lamp wire attach to conducting tape, TFT-LCD Module have a low luminance and the inverter has abnormal action because leakage current occurs between lamp wire and conducting tape.
6. The relative humidity must not exceed 80% non-condensing at temperatures of $40^{\circ}C$ or less. At temperatures greater than $40^{\circ}C$, the wet bulb temperature must not exceed $39^{\circ}C$. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.
7. Specified values are for a single lamp only which is aligned horizontally. The lifetime is defined as the time which luminance of the lamp is 50% compared to its original value.

[Operating condition: Continuous operating at $T_a = 25 \pm 2^{\circ}C$]

3.2 Interface Connections

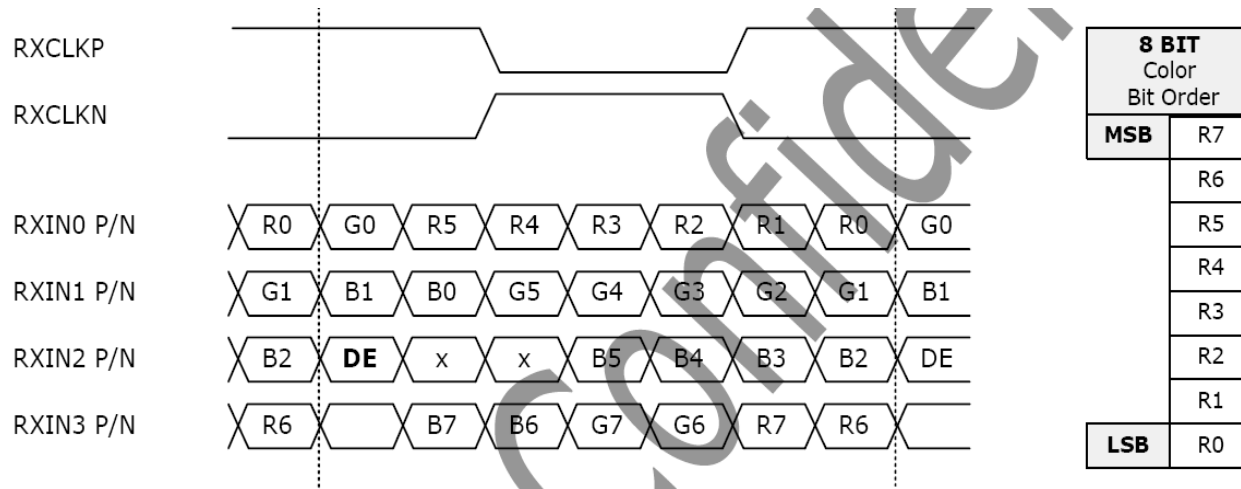
LCD connector (CN1): STARCON 106F30_000000_A2_R

Pin No	Symbol	Description	Note
1	Reserved	No connect	AUO internal test pin
2	Reserved	No connect	AUO internal test pin
3	Reserved	No connect	AUO internal test pin
4	GND	Ground	
5	Rx0-	LVDS Channel 0 [Polarity: Negative]	
6	Rx0+	LVDS Channel 0 [Polarity: Positive]	
7	GND	Ground	
8	Rx1-	LVDS Channel 1 [Polarity: Negative]	
9	Rx1+	LVDS Channel 1 [Polarity: Positive]	
10	GND	Ground	
11	Rx2-	LVDS Channel 2 [Polarity: Negative]	
12	Rx2+	LVDS Channel 2 [Polarity: Positive]	
13	GND	Ground	
14	RXCLK-	LVDS Clock [Polarity: Negative]	
15	RXCLK+	LVDS Clock [Polarity: Positive]	
16	GND	Ground	
17	Rx3-	LVDS Channel 3 [Polarity: Negative]	
18	Rx3+	LVDS Channel 3 [Polarity: Positive]	
19	GND	Ground	
20	Reserved	No connect	AUO internal test pin
21	LVDS Option*	Low for JEIDA, High/Open for NS	
22	WP	High(3.3V) for writable, Low (GND) for Protection	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	Vdd (+5V)	5V, DC, Regulated	
27	Vdd (+5V)	5V, DC, Regulated	
28	Vdd (+5V)	5V, DC, Regulated	
29	Vdd (+5V)	5V, DC, Regulated	
30	Vdd (+5V)	5V, DC, Regulated	

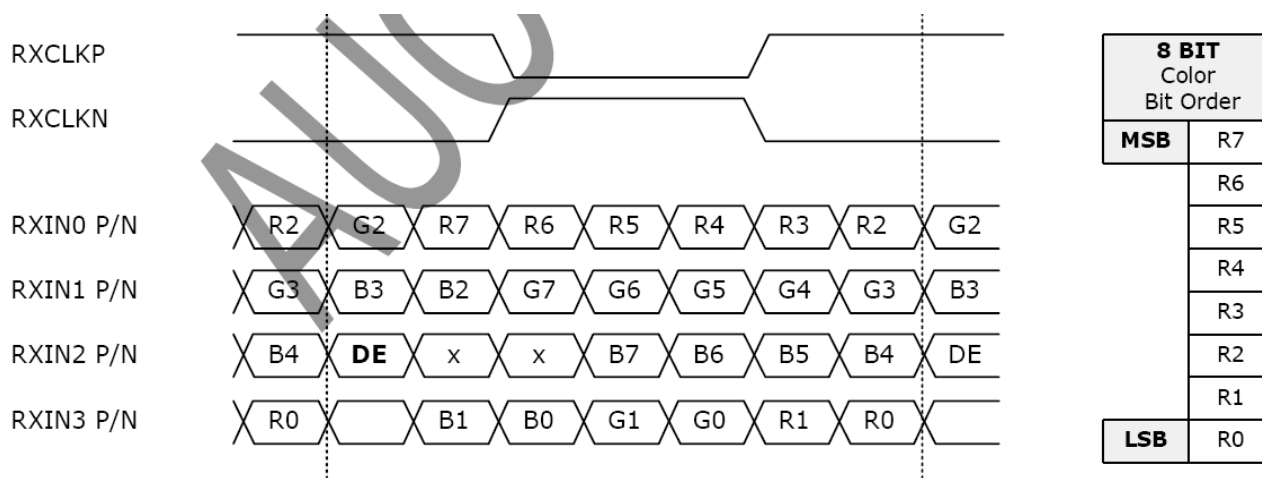
Note :

1. All GND (ground) pins should be connected together and should also be connected to the LCD's metal frame.
2. All Vcc (power input) pins should be connected together.

* **SELLVDS = High (3.3V) or Open, NS Format**



* **SELLVDS = Low (GND), JEIDA Format**



3.3 Signal Timing Specification

This is the signal timing required at the input of the User connector. All of the interface signal timings should be satisfied with the following specifications for the proper operation.

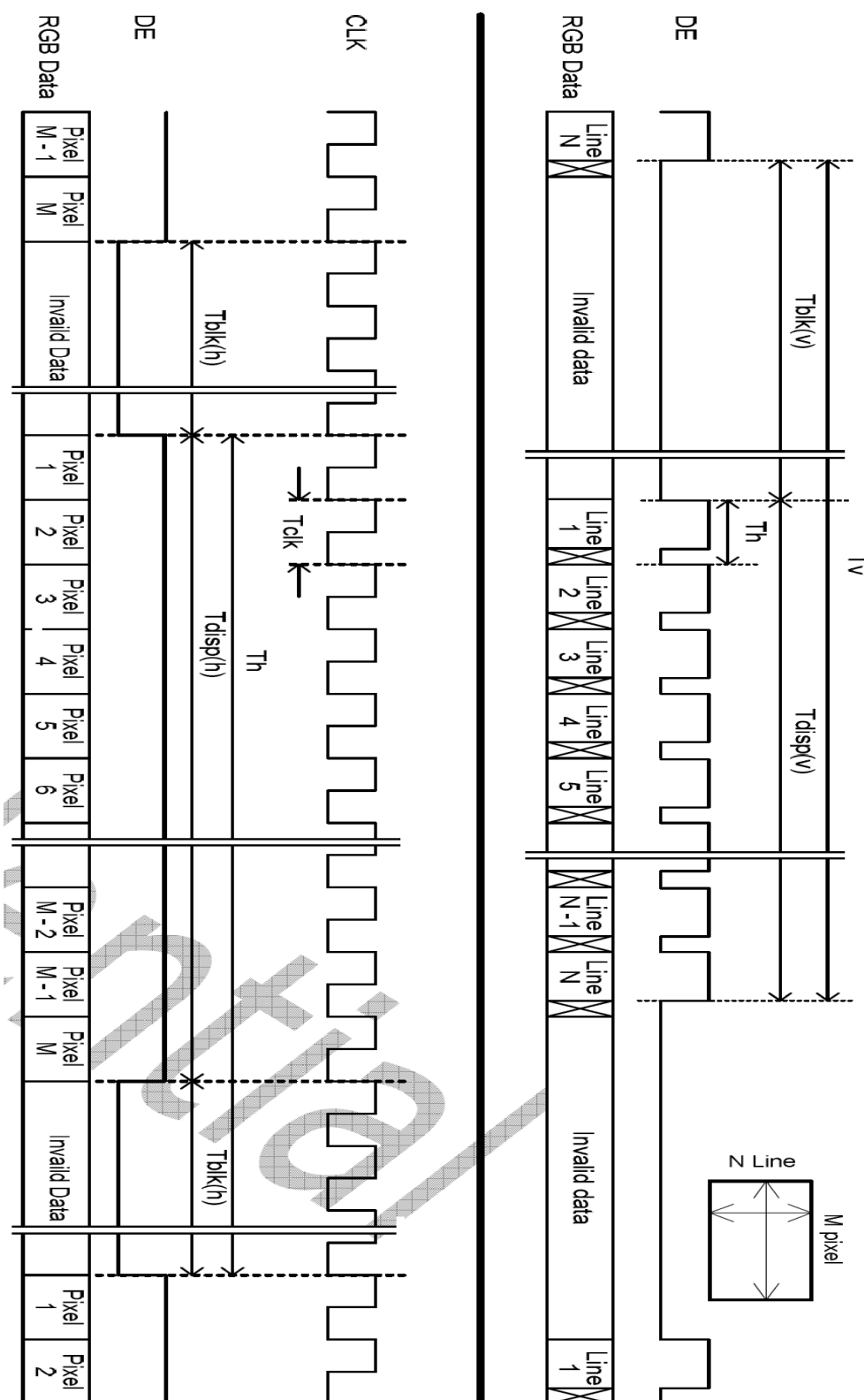
* Timing Table

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	T_v	784	810	1015	Th
	Active	$T_{disp}(v)$	768			Th
	Blanking	$T_{blk}(v)$	16	42	247	Th
Horizontal Section	Period	T_h	1460	1648	2000	Tclk
	Active	$T_{disp}(h)$	1366			Tclk
	Blanking	$T_{blk}(h)$	94	282	634	Tclk
Clock	Frequency	$F_{clk}=1/T_{clk}$	50	80	86	MHz
Vertical Frequency	Frequency	F_v	47	60	63	Hz
Horizontal Frequency	Frequency	F_h	43	48	53	KHz

Note :

1. Display position is specific for the rise of DE signal only. Horizontal display position is specified by the falling edge of 1st CLK right after the rise of DE, is displayed on the left edge of the screen. Vertical display position is specified by the rise of DE after a "Low" level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of DE is displayed at the top line of screen.
2. If a period of DE "High" is less than 1,366 CLK or less than 768 lines, the rest of the screen displays black.
3. The display position does not fit to the screen if a period of DE "High" and the effective data period do not synchronize with each other.

3.4 Signal Timing Waveforms



3.5 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8 bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

COLOR DATA REFERENCE

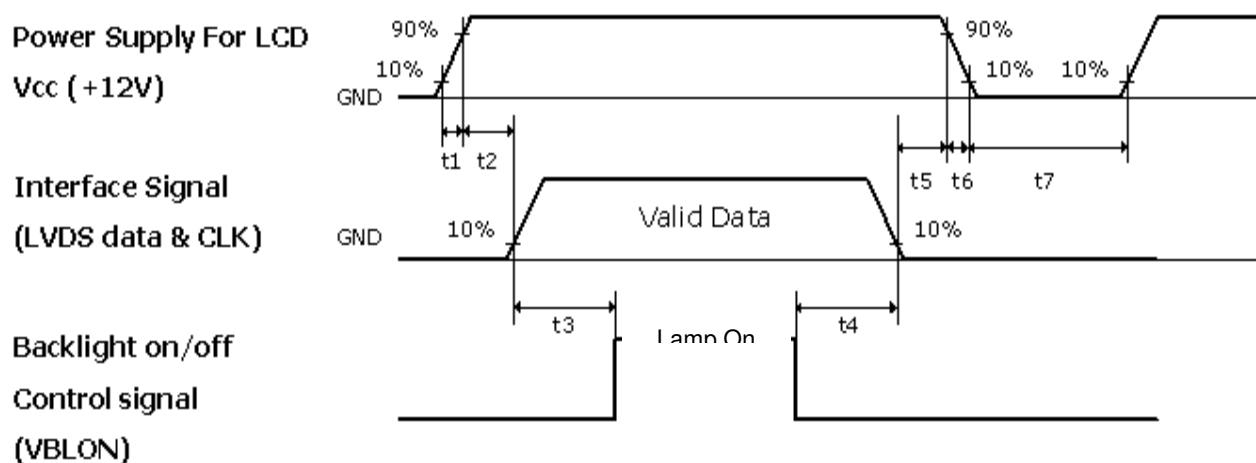
Color		Input Color Data																							
		RED								GREEN								BLUE							
		MSB				LSB				MSB				LSB				MSB				LSB			
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	RED(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	GREEN(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
B	BLUE(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3.6 Power Sequence for LCD



Parameter	Values			Unit
	Min.	Typ.	Max.	
t1	0.4	-	30	[ms]
t2	0.1	-	50	[ms]
t3	200	-	-	[ms]
t4	10	-	-	[ms]
t5	0.1	-	50	[ms]
t6	-	-	300	[ms]
t7	500	-	-	[ms]

Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

Caution :

The above on/off sequence should be applied to avoid abnormal function in the display. In case of handling, make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

3.7 Backlight Specification

The backlight unit contains 3-U type CCFLs (Cold Cathode Fluorescent Lamp)

Electrical specification (Recommended)

Item	Symbol	Condition	Spec			Unit	Note
			Min.	Typ.	Max.		
Operating Voltage	Vo	-	-	1020	-	[Vrms]	-
Operating Current	Io	-	14.5	15	15.5	[mArms]	-
BL Total Power Dissipation	PBL	-	45	50	55	[Watt]	-
Striking Voltage	Vstk	At 0°C	-	-	2300	[Vrms]	-
		At 25°C	-	-	2000		
Striking Time	Ts	-	1000	-	1500	[msec]	-
Operating Frequency	fo	-	53	55	57	[kHz]	1
PWM Operating Frequency	F_PWM	-	140	180	240	[Hz]	-
PWM Dimming Duty Ratio	D_PWM	-	20	-	100	[%]	2,3,4
Lamp Type			U type			-	-
Number of Lamps			3			[PC]	-

(Ta=25±5°C , Turn on for 45minutes)

Note 1: The lamp operating frequency may induce interference with data horizontal frequency, and may cause line noise on the screen. In order to avoid interference, the lamp operating frequency should be set far away from data horizontal frequency.

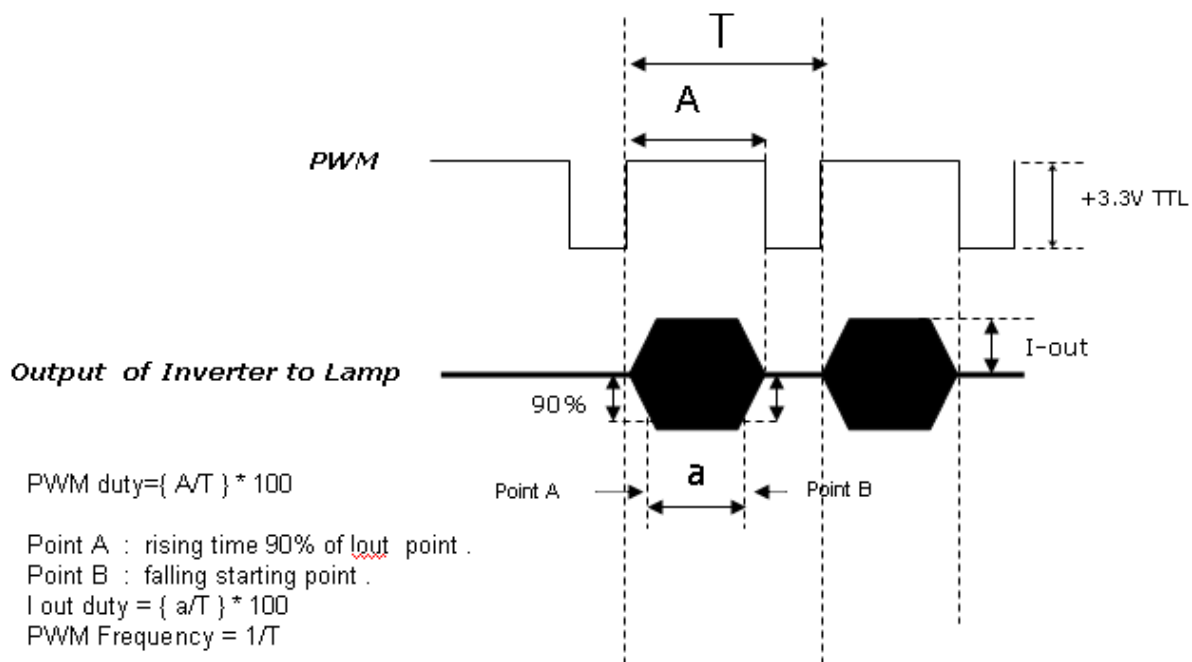
Note 2: Dimming range



PWM Dimming : include Internal and External PWM Dimming

Note 3: Low Dim ratio operation
 Duty lowered for LIPS design Display

Note 4: Duty ratio definition.



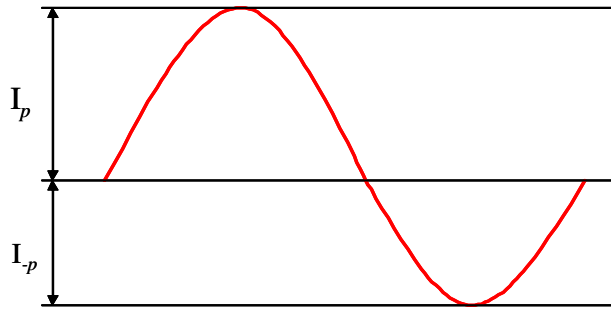
Lamp specification

Item	Symbol	Condition	Spec			Unit	Note
			Min.	Typ.	Max.		
Lamp voltage	VL	-	-	1020	-	[Vrms]	-
Lamp current	IL	-	14.5	15.0	15.5	[mA rms]	-
Lamp frequency	fL	-	40	-	80	[kHz]	-
Starting voltage	Vs	At 0°C	-	-	2300	[Vrms]	-
		At 25°C	-	-	2000	[Vrms]	-
Delayed discharge time	TD	-	-	-	0.5	[sec]	-
Life time	TL	-	30K	-	-	[hr]	-
Unsymmetrical ratio	UR	-	-	-	10%	-	1
Crest factor	C.F.	-	$\sqrt{2} - 10\%$	$\sqrt{2}$	$\sqrt{2} + 10\%$	-	

The above characteristics are measured under the conditions:
Ambient temperature: 25±2°C, Relative Humidity: 65±20%RH.

Note 1: Waveform definition

Please light on the lamp with symmetrical voltage and current waveform (unsymmetrical ratio is less than 10%, crest factor within $\sqrt{2} \pm 10\%$).



$$\text{Unsymmetrical Ratio} = |I_p - I_{-p}| / I_{rms} * 100\%$$

$$\text{Crest Factor} = I_p \text{ (or } I_{-p}) / I_{rms}$$

I_p : High side peak value

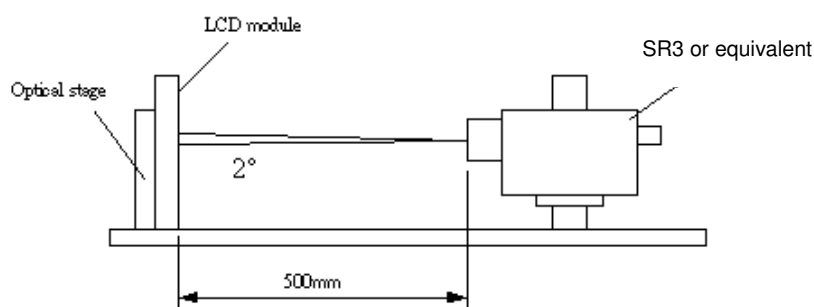
I_{-p} : Low side peak value

I_{rms} : Root mean square value

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of ϕ and θ equal to 0°.

Fig.1 presents additional information concerning the measurement equipment and method.



Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max		
Contrast Ratio		CR	1600	2000	--		1
Surface Luminance (White)		L_{WH}	250	300	--	cd/m ²	2
Luminance Variation		$\delta_{WHITE(9P)}$	--	--	1.3		3
Response Time (G to G)		T_Y	--	6.5	--	Ms	4
Color Gamut		NTSC		72		%	
Color Coordinates							
	Red	R_X	Typ.-0.03	0.64	Typ.+0.03		
		R_Y		0.33			
	Green	G_X		0.28			
		G_Y		0.59			
	Blue	B_X		0.14			
		B_Y		0.06			
	White	W_X		0.29			
		W_Y		0.30			
Viewing Angle							5
	x axis, right($\phi=0^\circ$)	θ_r	--	88	--	degree	
	x axis, left($\phi=180^\circ$)	θ_l	--	88	--	degree	
	y axis, up($\phi=90^\circ$)	θ_u	--	88	--	degree	
	y axis, down ($\phi=270^\circ$)	θ_d	--	88	--	degree	

Note:

1. Contrast Ratio (CR) is defined mathematically as:

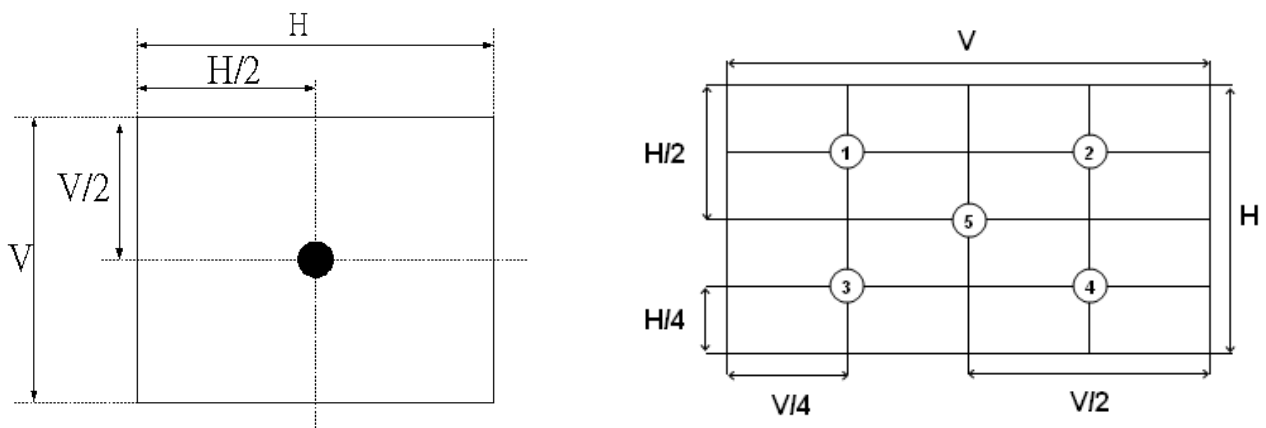
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{\text{on5}}}{\text{Surface Luminance of } L_{\text{off5}}}$$

2. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. When lamp current $I_H = 15\text{mA}$. $L_{\text{WH}} = L_{\text{on5}}$ where L_{on5} is the luminance with all pixels displaying white at center 5 location.
3. The variation in surface luminance, δWHITE is defined (center of Screen) as:

$$\delta\text{WHITE(9P)} = \text{Maximum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on5}}) / \text{Minimum}(L_{\text{on1}}, L_{\text{on2}}, \dots, L_{\text{on5}})$$
4. Response time T_γ is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on $F_v=60\text{Hz}$ to optimize.

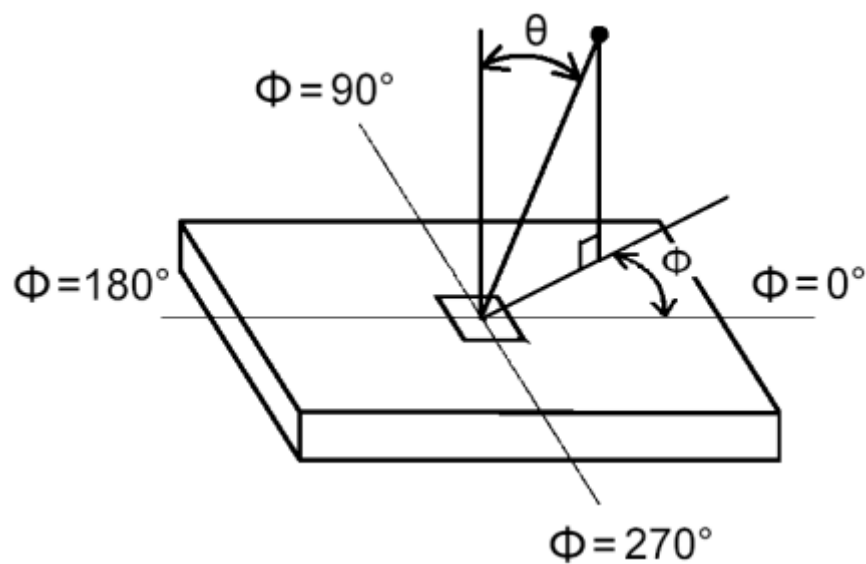
Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

FIG. 2 Luminance



5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG3.

FIG.3 Viewing Angle

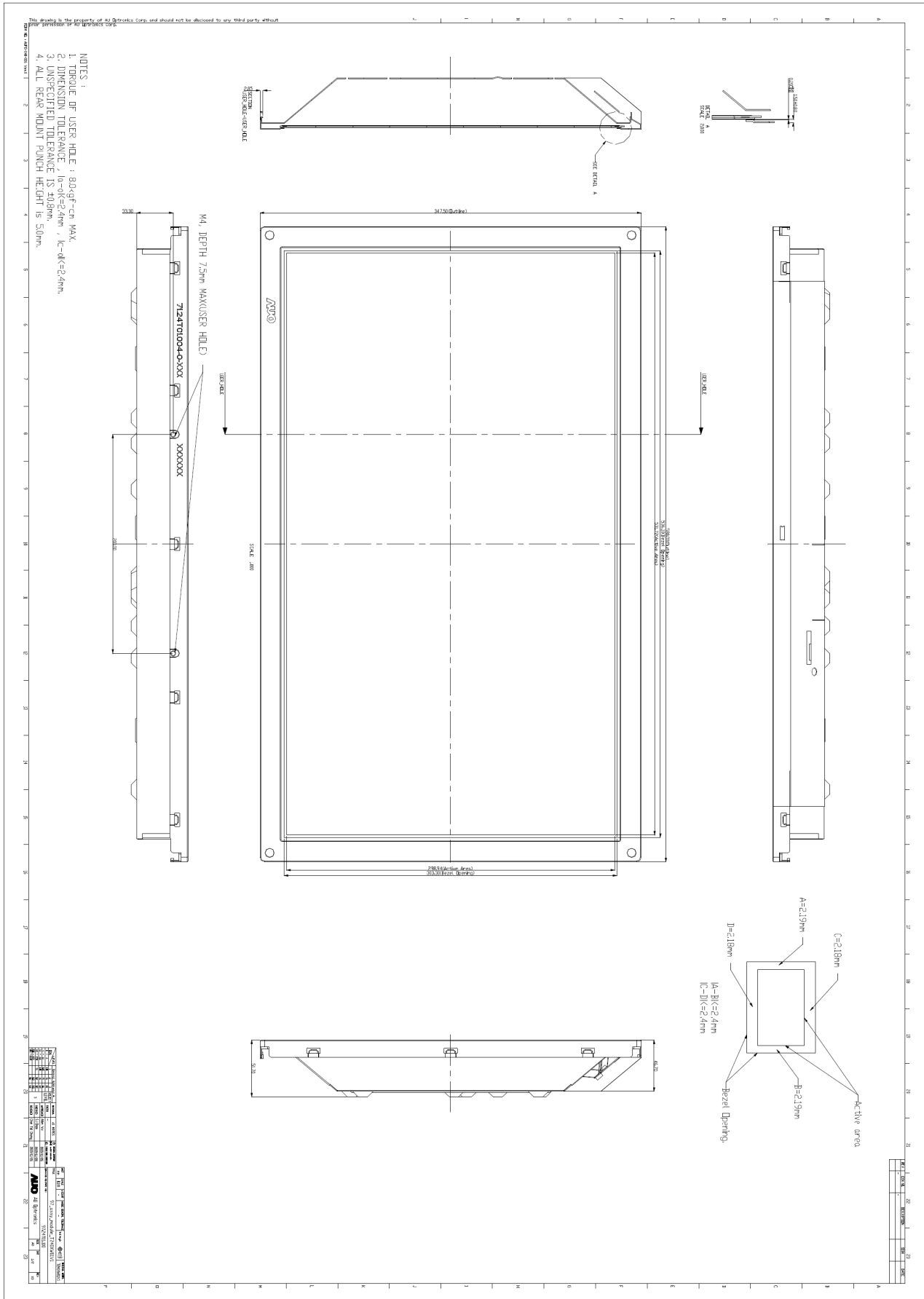


5. Mechanical Characteristics

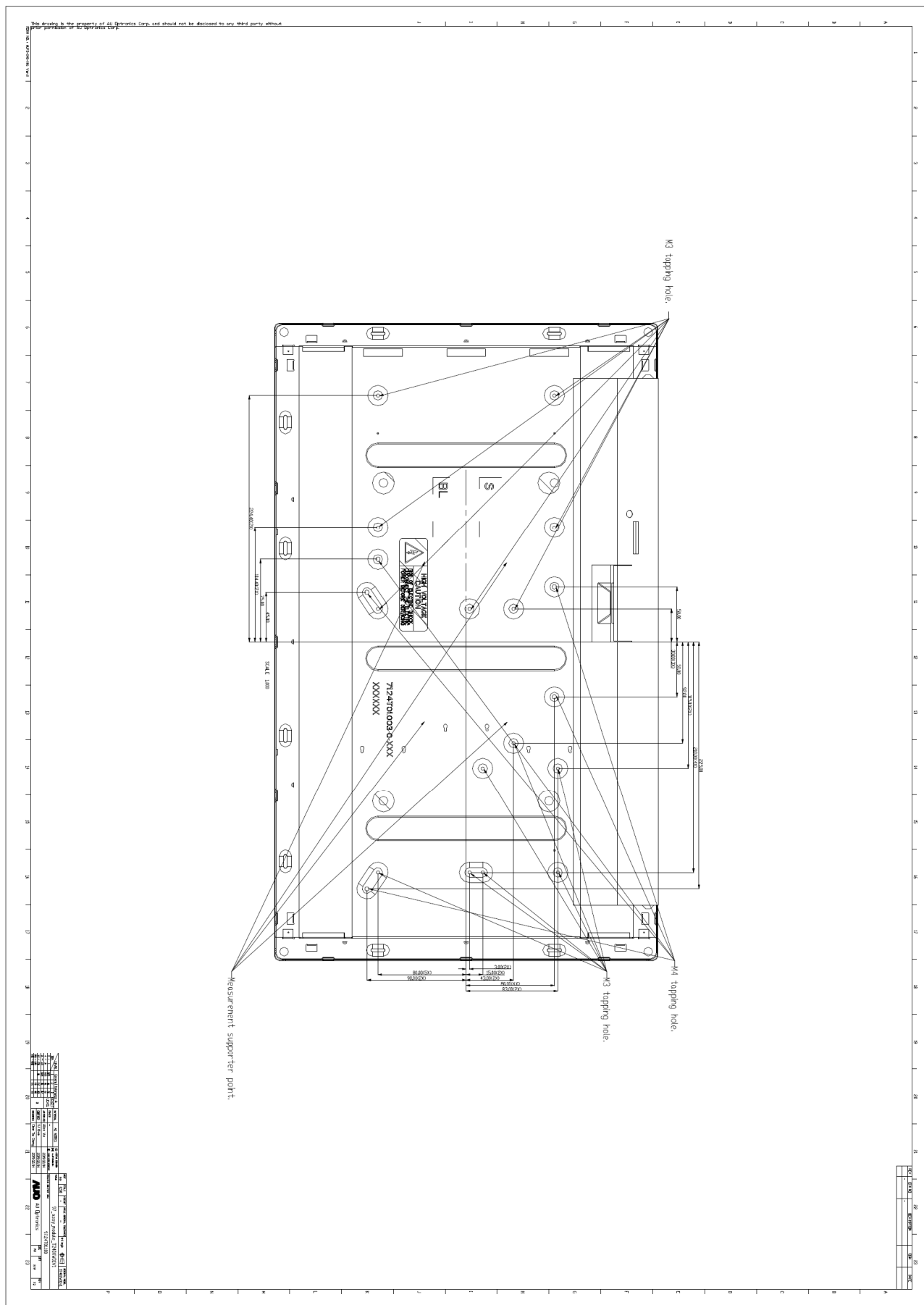
The contents provide general mechanical characteristics for the model T240XW01 V1. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	580.0 mm
	Vertical	347.5 mm
	Depth	46.7mm
Bezel Opening	Horizontal	536.1 mm
	Vertical	303.3 mm
Active Display Area	Horizontal	531.7mm
	Vertical	298.9 mm
Weight	2800 g (Typ.)	
Surface Treatment	Anti-Glare, 3H	

Front View



Back View



6. Reliability Test Items

	Test Item	Q'ty	Condition
1	High temperature storage test	3	60°C , 300hrs
2	Low temperature storage test	3	-20°C , 300hrs
3	High temperature operation test	3	50°C , 300hrs
4	Low temperature operation test	3	-5°C , 300hrs
5	Vibration test (non-operation)	5 (TBD)	Wave form: random Vibration level: 1.5G RMS Bandwidth: 10-300Hz, Duration: X, Y, Z 30min One time each direction
6	Shock test (non-operation)	5 (TBD)	Shock level: 50G Waveform: half sine wave, 11ms Direction: $\pm X$, $\pm Y$, $\pm Z$, One time each direction
7	Vibration test (With carton)	5 (TBD)	Random wave (1.5G RMS, 10-200Hz) 30mins/ Per each X,Y,Z axes
8	Drop test (With carton)	5 (TBD)	Height: 45.7m 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)

7. International Standard

7.1 Safety

- (1) UL 60950-1, UL 60065; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
- (2) IEC 60950-1 : 2001, IEC 60065:2001 ; Standard for Safety of International Electrotechnical Commission
- (3) EN 60950 : 2001+A11, EN 60065:2002+A1:2006; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

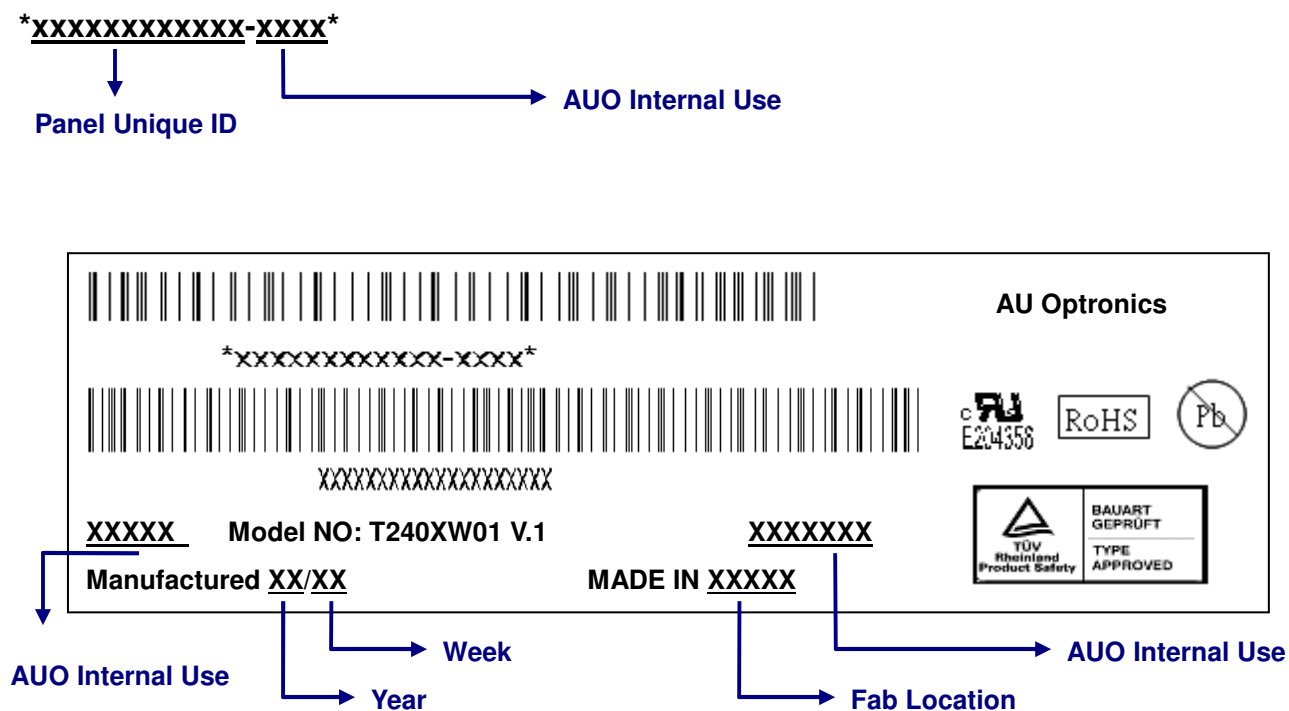
7.2 EMC

- (1) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992
- (2) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (3) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

8. Packing

8-1 DEFINITION OF LABEL:

A. Panel Label:



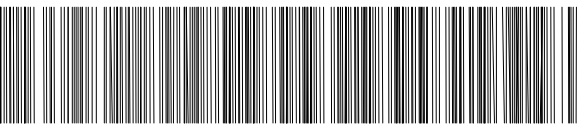
Green mark description

(1) For Pb Free Product, AUO will add  for identification.

(2) For RoHS compatible products, AUO will add  for identification.

Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

B. Carton Label:

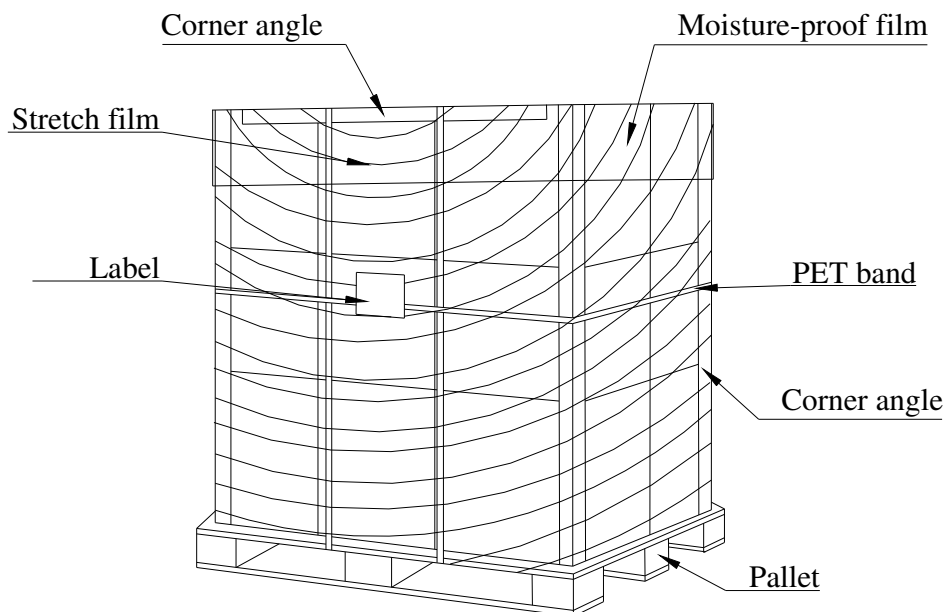
AU Optronics	QTY :		
MODEL NO: T240XW01 VX			
PART NO: 97.24T01.XXX			
CUSTOMER NO:			
CARTON NO:			
Made in XXXXXX	*XXXXX-XXXXXXXXXX*		

8-2 PACKING METHODS:

TBD

8-3 Pallet and Shipment Information

	Item	Specification			Packing Remark
		Qty.	Dimension	Weight (kg)	
1	Packing BOX				
2	Pallet		TBD		
3	Boxes per Pallet				
4	Panels per Pallet				
	Pallet after packing				



8. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

9-1 MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause circuit broken by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2 OPERATING PRECAUTIONS

- (1) The device listed in the product specification sheets was designed and manufactured for TV application
- (2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage:
 $V = \pm 200\text{mV}$ (Over and under shoot voltage)
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer..)
- (4) Brightness of CCFL depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (5) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (6) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (7) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall

be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

9-3 ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc. And don't touch interface pin directly.

9-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5 STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

9-6 HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.